Cycles of nature evident in short walk through wildlife refuge

by Ed Berg

After a recent snowfall, I took a midday walk in the woods to look at some of the fine points of winter life.

Normally I am zipping along on my skis, often by headlight, and I miss the details. Today, I am checking out some of the smaller denizens of the woods around the Kenai National Wildlife Refuge headquarters.

Snowshoe hare tracks are abundant, even though we are three years down from the peak of the hare cycle. We have monitored hares by live traps and pellet counts since 1983 and have documented a full cycle from the 1984 high, through the rock-bottom lows of 1988-93, and then the 1996-98 high.

I soon pick up a shrew track crossing the trail. This is just about the most delicate track you can find in fresh snow. It looks like a necklace, with pairs of tiny footprints spaced about two inches apart, probably made by hopping. The entire track is no more than an inch wide, and there is a hint of a tail trace connecting the pairs of footprints. The tracks emerge from under a stump and run 20 feet before disappearing into a tunnel in a clump of willow. Down on my hands and knees, I can see a few inches into the fragile snow tunnel.

In the spring, these tunnels are often revealed for a few days just as the snow is finally melting off. At that time, long runways can easily be followed, where the small mammals, especially voles, have eaten through the grass and litter.

I puzzle about why a shrew or vole would ever bother to surface during the winter. They have more tunnels than the Taliban, and basically live in a well-insulated, well-connected world away from the watchful eyes of airborne predators. The tracks that I see on top of the snow are quite businesslike, from point A to point B, with no pauses for nibbling or meandering. This is a war zone, and dawdlers may soon be somebody's dinner.

Not that life in the tunnels is all snugness and warmth. Voles, I suspect, do most of the heavy construction work. They are basically vegetarians and are able to auger through the sod and reduce a well-manicured lawn to a labyrinth of crisscrossed grooved channels.

Shrews, however, are voracious predators (with a heart rate of 1,200 beats per minute), and like to eat more than their body weight per day in high-protein food, such as insects, voles and other shrews. A vole's worst nightmare is probably a shrew loose in its tunnels.

Continuing on my walk, I find many more shrew tracks, but nothing that I can identify as vole tracks. We have caught four masked shrews in the office in the last week, so I think that next summer may be a big year for shrews—and probably voles as well, because they cycle together.

The strong boom-and-bust cycles of small mammals have long puzzled North Country naturalists. The 9- to 11-year snowshoe hare (and lynx) cycle is well documented from the Hudson Bay Fur Company records since the 1840s. Recent studies have used tree rings in the Yukon to track the hare cycle back to the 1750s and have convincingly correlated it with sunspot cycles.

Just how sunspots might be affecting the hares is completely unknown, but weather variables (such as temperature, air pressure and drought) are strongly correlated with sunspot cycles in some parts of the world. On the Kenai, we see a strong 9- to13-year cycle in tree rings in the Tustumena Lake area, which suggests a sunspot connection.

I recently had an opportunity to discuss population cycles with a visiting researcher from the Arctic Institute field station near Kluane Lake in the Yukon. Elizabeth Hofer has lived and worked as a wildlife biologist in the Yukon for more than 30 years, frequently collaborating with Canadian researchers Rudy Boonstra (University of Toronto) and Charles Krebs (University of British Columbia).

Liz explained that there are basically two kinds of theories about population cycles: extrinsic factors (increased predation, overbrowsed plants, diseases, parasites, weather, etc.) and intrinsic factors (something is "wrong" with the animals). It is well known that

predators (e.g., lynx, wolves, hawks and owls) move in and reproduce well during a hare maximum, and no doubt hammer the heck out of the bunnies.

A similar influx of predators (especially weasels) can hammer the voles and shrews during their highs.

The Achilles heel of all cycle theories, according to Boonstra, is the low phase of the cycle. What keeps the hares down at rock bottom numbers for two to six years, and the small mammals for one to three years, after the predators have declined and the vegetation has regrown?

Many investigators, including Boonstra and Krebs, have conducted various predator removal or exclosure experiments during the lows of hare and small mammal cycles and have found that this protection didn't have any significant effect on critter numbers. At Kluane Lake Boonstra and Krebs artificially fed rabbit chow to two populations of hares during the 1983-87 low phase and found that this didn't help either. It's like the animals were determined to do poorly, regardless of how the experimenters tried to help them.

Boonstra's pet hypothesis is that there is something wrong with mothers during a population low phase. (I hate to see mothers knocked again, but the evidence is persuasive!) Boonstra measured various blood factors during an intense decline phase and found the animals to be highly stressed by the threat of imminent predation.

Combat veterans will find this obvious, but the remarkable fact is that the stress effect carries over into the offspring and grandoffspring. This is "post-traumatic stress syndrome" for the grandchildren and beyond. Boonstra demonstrated the existence of a "maternal effect" in the laboratory by raising vole mothers under ideal conditions for several generations. Mothers that were captured during a population low phase (and subsequently their offspring) continued to have reduced reproductive output for the next three generations. They had, in fact, about half has many offspring as did mothers—and their progeny—captured during a population increase phase. This is an extremely strong maternal effect, whatever its cause may be. With human beings, we recognize that "poverty breeds poverty." But poverty doesn't generally translate into fewer children, grandchildren and great-grandchildren.

There is much to be learned about these remarkable hare and small mammal cycles. Rudy Boonstra posed a very insightful question when he asked, what keeps the populations low for so many years, when the predation and food pressure is off? Framing the question this way naturally suggested focusing on the animals' physiological and reproductive condition. Tracking this condition from one generation to the next then led to the "maternal effects" concept. This is a nice example of how reframing a question can open up an entirely new line of inquiry.

Ed Berg has been the ecologist at the Kenai National Wildlife Refuge since 1993. He will be discussing this research in more detail in his one-credit "Cycles of Nature" class at the Kenai Peninsula College, Tuesday evenings, March 26-April 23. Call the College for information (262-0300). For more information about the Refuge, visit the headquarters on Ski Hill Road in Soldotna, call 262-7021 or see the website at http://www.fws.gov/refuge/kenai/.